Sir Frederick Snow & Partners Ltd

SILSDEN PRIMARY SCHOOL
SURFACE WATER DRAINAGE AND SUDS STRATEGY

FS 4801

Rev	Date	Reason for Revision
R01	10 Oct 17	Issued for Review
R02	1 Nov 17	Revised retention to attenuation

Authorisation Record		Civil Engineer	Lead Civil/Structural Engineer	Project Engineer
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Rev	Date	Prepared by	Recommended by	Approved by

REVISION RECORD SHEET

Revision Number	Purpose	List of Updated/Modified Sections, if any
R01	Issued for Review	
R02	Issued for approval	Retention to attenuation

HOLDS

HOLD No.	Section Ref.	Description of HOLD
1		
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CONTENTS

1. SCOPE

This document defines the basic requirements for SUDS to be considered for the design of the civil engineering works constructed as part of the permanent and construction works for Silsden Primary School.

2. DEFINITIONS

Throughout this specification, the following definitions shall apply:

COMPANY: Shall mean City of Bradford MDC, or their representative.

CONTRACTOR: Shall mean the CONTRACTOR appointed and for Works at Silsden Primary School in the CONTRACT with COMPANY, or their representative.

3. ABBREVIATIONS

BOD	Biological Oxygen Demand
CIRIA	Construction Industry Research and Information Association
EPA	Environment Protection Agency
RPC	Runoff Percentage Coefficient
SUDS	Sustainable Drainage Systems
SPS	Silsden Primary School
SS	Suspended Solids

4. REFERENCE DOCUMENTS

This document should be in accordance with the reference documents including codes and standards listed below.

Unless otherwise stipulated in the CONTRACT, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of the Contract. References to superseded standards that may occur on technical documents will not over-write this clause.

CIRIA C697	The SUDS Manual

5. SUSTAINABLE DRAINAGE SYSTEMS (SUDS) - REQUIRED PROVISIONS

For a development complex such as this, CIRIA C697, The SUDS Manual, would require basic levels of SUDS treatment dependent on the nature and level of pollution likely to be required to be dealt with in addition to some form of barrier containment measures to deal with any high risk contaminant chemicals and substances associated with any processes.

SUDS systems designed in accordance with CIRIA C697, The SUDS Manual, are designed and sized on a volumetric basis with various multipliers of the calculated factor known as 'Treatment Volume Vt'. The SUDS Retention Pond in this case is designed to have a permanent water pool volume of 4 times the 'Treatment Volume Vt' and this level of permanent water pool volume should provide a residual pond time of approximately 15 to 20 days during the wettest months. The following points are made in relation to potential levels of BOD and suspended solids in the discharge from the SUDS Retention Pond as proposed:

The EPA requirement is taken to be 20mg/l Biological Oxygen Demand/30mg/l Suspended Solids.

It is considered that polluted surface water run-off from the proposed school will be minimal since there have been no significant contamination found and no significant polluting processes to be undertaken on the site. On this basis the surface run off is not expected to contribute any significant storm surge loading, biological loading or suspended solids load to any SUDS Retention Pond.

In terms of the containment measures and SUDS treatments proposed for this project we have outlined our proposals to deal with the surface water runoff within the site in the form of a Run off Quality Treatment and Control Management Train, described below.

6. RUN OFF QUALITY TREATMENT AND CONTROL MANAGEMENT TRAIN

6.1 STAGE 1.

Provision of covered containment bunding around any specific hazardous chemical and oil/hydrocarbon storage and process equipment within the school grounds, that are identified as having a medium to high risk of spillage or contamination emissions. The hazardous fluids collected within the containment bunding will be drained via the designated closed drains system to the Closed Drains Drum for storage before return transfer back to any process and /or disposal off site.

6.2 STAGE 2.

Hardstanding surface areas within the school grounds that are liable to moderate levels of contamination by oil or hydrocarbon products will be drained by positive drainage gullies or linear drainage channels to petrol interceptors. Typically the car park, delivery and set down areas. These will be By-pass type to contain the first flush of any storm.

6.3 STAGE 3.

Hardstanding surface areas within the school grounds, which are liable to only infrequent low levels of direct contamination by oils or hydrocarbon products, including general roads and pavements, will be constructed with permeable/porous paved hardstanding surfacing overlying a depth of contained granular filter material with discharge from the bottom of the layer of granular filter material being by means of perforated drainpipes leading into oil free classified drains with inspection chambers/manholes and thereafter to conveyance drains leading to and discharging into the SUDS water attenuation system.

6.4 STAGE 4.

All access roads within the School grounds will be drained to linear filter drains along the side and for the lengths of the roads connecting into conveyance filter drains leading to and discharging into the SUDS water attenuation system.

6.5 STAGE 5.

On the basis of the layout and levels of the proposed School grounds it is intended to be served by a SUDS water attenuation swale located in the south west corner of the site. If this footprint area in insufficient then a second SUDS swale pond could be located between the football pitch and the MUGA. The discharge outlets from the constructed SUDS swale areas will be fitted with a flow control devise, such as a reduced diameter discharge pipe, a weir or hydro-brake, to control and regulate the pond discharge to the local sewer system.

6.6 STAGE 6.

There is a fairly large catchment area of natural/landscaped land within the School grounds for the proposed School layout, which falls towards the southern boundary where a cut off land drain collects its surface water run off to prevent it from entering the adjacent properties. The collected surface water run off from this natural catchment area will be reduced by the school design and so are considered to be captured sufficiently by the existing drainage to the site.

7. DESIGN SIZE OF SUDS ATTENUATION SYSTEM

7.1 SUDS ATTENUATION

We will first consider the retained volume where Vt is the treatment volume assessed on a level of first flush run off from impermeable surfaces with a depth of 15mm, as outlined in Section 4.5.6 of CIRIA 697, The SUDS Manual.

On this project the drainage network comprises surface water run off from a variety of areas including water storage, i.e. water retention pond; hard standings, i.e roads and paths; school ground and landscape areas whose impermeability and therefore run off percentages vary quite markedly. To allow for this variation in run off from the various areas the following run off percentage coefficients have been applied to the area groups:

Area Group	Run off Percentage Coefficient (RPC)	
Water Surfaces	0.95	(Allowing for evaporation loss)
Hardstanding Areas	0.90	(Allowing for evaporation + conveyance losses)
School Areas	0.25	(Mainly gravelled covered with some hardstandings)
Landscaped Areas	0.25	(Existing natural or cultivated land surface)

List of Land Area Draining To SUDS Pond

Catchments	Areas m2	RPC	RPCxArea	
School buildings	30,000	0.9	27,000	
Car Park	24,000	0.9	21,600	
Roads and pavements	40,000	0.9	36,000	
School Yards	38,000	0.25	9,500	
Landscaped	258,000	0.25	64,500	
total run off area	390,000		158,600	Vt= 2,379m3

When the above noted land areas are multiplied by their appropriate RPC and the resulting run off areas are taken cumulatively with the first flush run off depth of 15mm a basic Treatment Volume Vt figure of 2,379m^3 is generated.

SUDS require storm event run off being effectively attenuated by storage of the designed volume. The attenuation system will be designed to provide the attenuation storage required for a 100year return period 60 minute duration storm using The Wallingford Procedure method to determine the appropriate run off flows.

The Wallingford Procedure's standard equation for post development flow relating to storm rainfall intensity and net impermeable area for an M100 - 60 storm event is 3.61CvAI, where:

- Cv or Runoff Percentage = varies from 0.25 (Landscaped Areas); 0.25 (Processed Areas); 0.9 (Road Areas) & 0.95 (Swale).
- Total A = 39ha.
- Net A as revised by appropriate runoff percentages coefficients = 15.86 ha including the landscape areas and I varies with duration, as outlined in the table below, for M5-60 a rainfall depth of 16.0 mm is taken for Silsden, as is the resultant attenuation volume required.

Post Development Flow is taken at 3.61 NetAI = 3.61.15.86.I = 57.25(I)

Limiting Greenfield Pre Flow is taken at 3.61CvAI = 3.61.0.2.39I = 28.16(I)

Duration Minutes	Z1 Factor	Z1.M5-60 mm	Z2 Factor	M100 Rainfall mm	Intensity I mm/hr	Inflow 3.61NetAI l/s	Limiting Outflow l/s	Net Flow To Storage l/s	Attenuation Volume Reqd. m^3
60	1.00	16.00	1.98	31.68	31.68	1814	892	922	3318

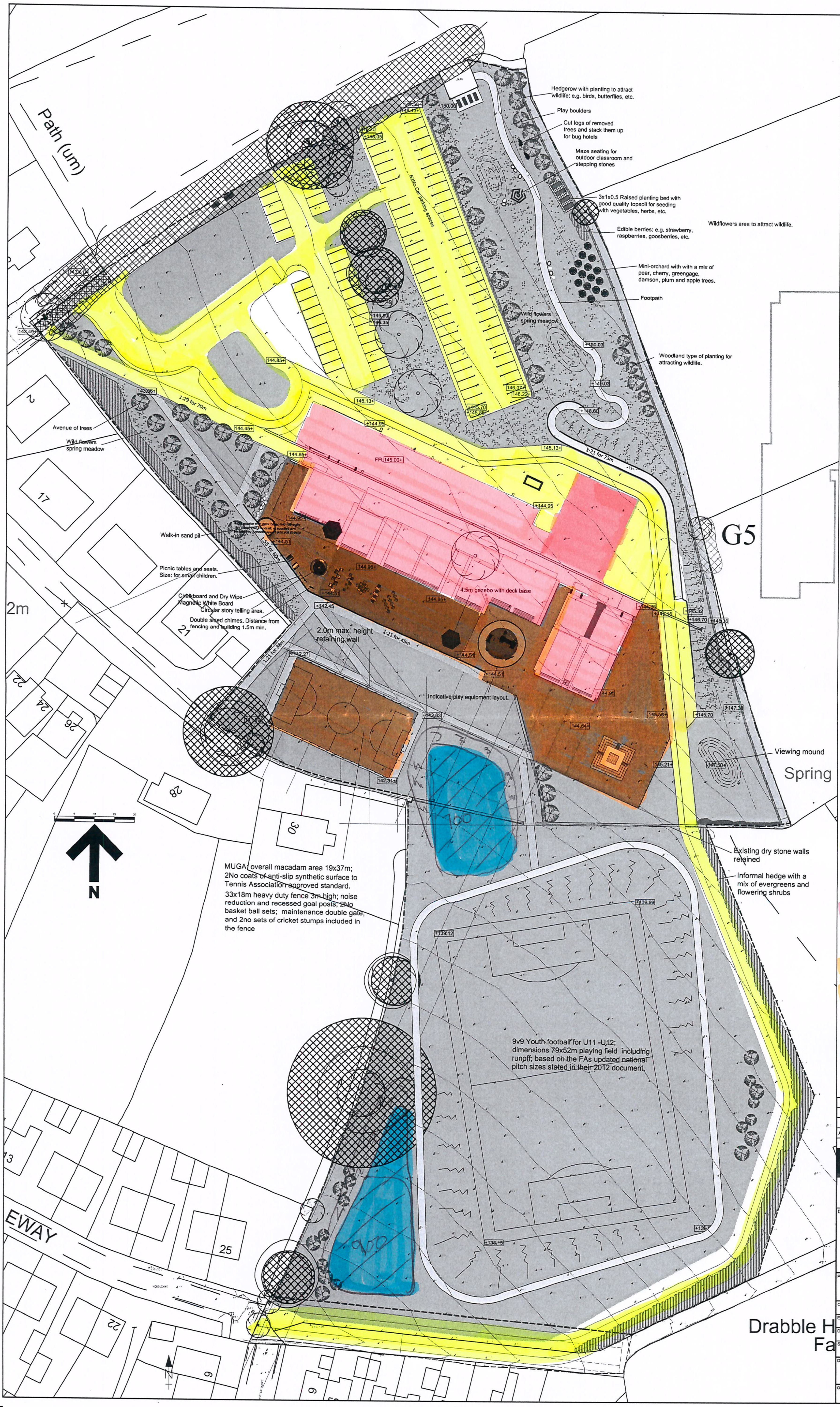
This M100 - 60 attenuation storage volume of 3318m^3 equates to a water depth of 2.07m taken over a twin pond surface area of 1600m2.

As can be seen from the figures in the above table the inflow to the SUDS attenuation system as proposed is some 1800 l/s and the required limiting outflow relating to pre development natural Greenfield run off is some 900 l/s. Basically double the original runoff flow.

To achieve these values one option is toutilise twin retention pond arrangement which requires discharge flow control to be established in both retention ponds with the discharge invert set at the permanent water level in each respective pond. The appropriate flow control on the discharge from the upper first retention pond to the lower second retention pond should be set at a maximum flow of approximately 1300 l/s and the flow control on the discharge from the lower second retention pond to the existing drainage system should be set at a maximum flow of 900 l/s to satisfy the limiting greenfield run off flow, as established above.

It is good practice to provide an emergency overflow from retention ponds to safely direct discharge flows in the event of a blockage to the discharge control/pipe or when the designed storm event is exceeded. In the SUDS swale system, as proposed, emergency overflows in the form of the pond bank level at/near to the pond discharge outlet being lower locally over a short length of 5m to a level of 0.5m above the swale holding water level with an associated flow channel being formed in the external pond bank slopes.

If an open swale is not preferred solution for a school then underground storage can be designed to contain the attenuation volume.



64,000m²

30,000m²

38,000m²

16,000m²

Revision	Inits	Date
A Original	TR	Sept 2017

City of Bradford MDC

www.bradford.gov.uk

Department of Place

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Project: SILSDEN NEW PRIMARY SCHOOL

Client:

Engineer to Contract:

Design	Drawn	Checked	Released
TR	TR		
Scale(s) @ A0	Approved		Date
1:300			Sept 2017

Drawing Title: LANDSCAPE PROPOSALS

Drawing No. L/103856/CDH/1A